

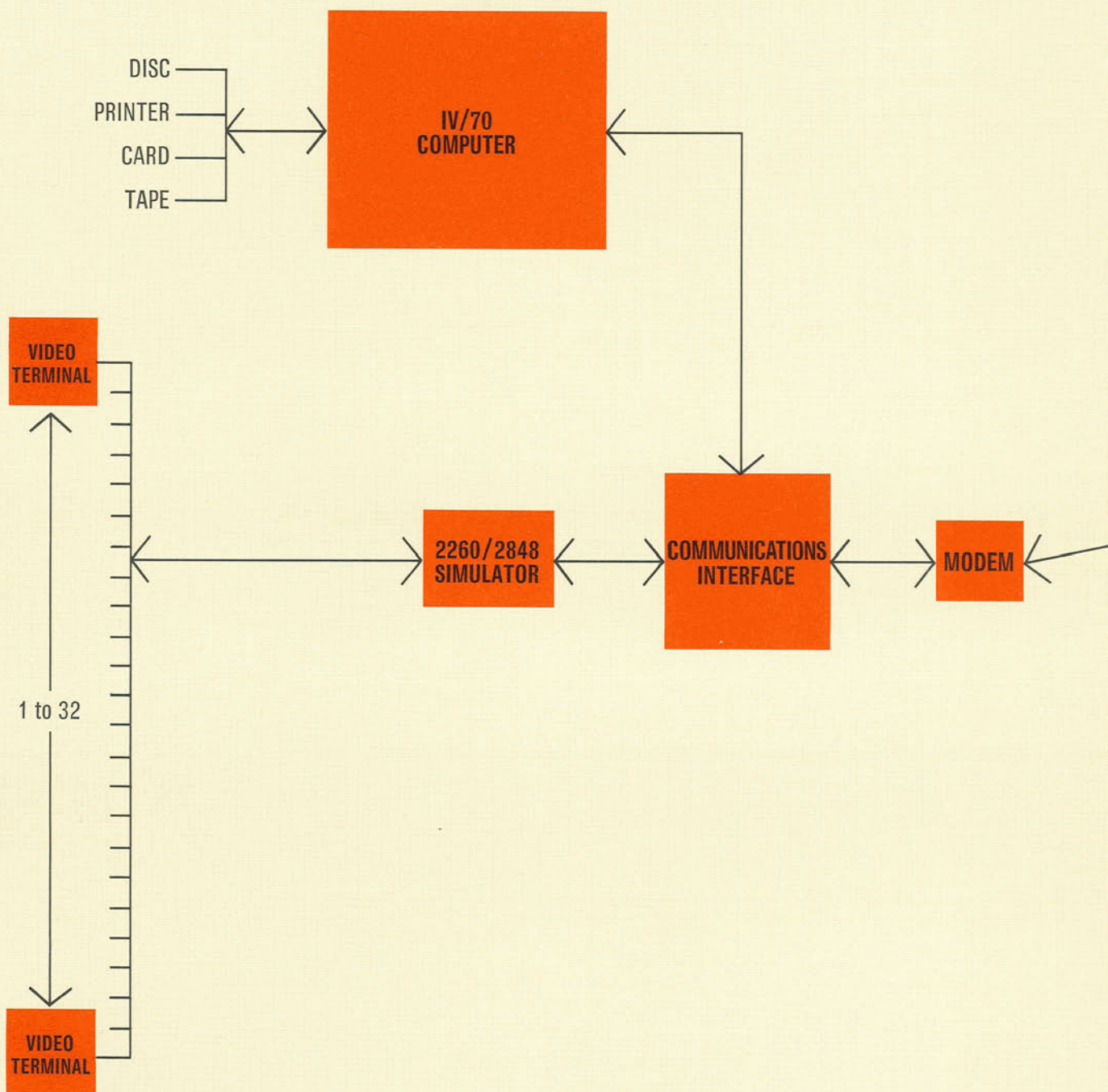
The data-base access system of the 70's



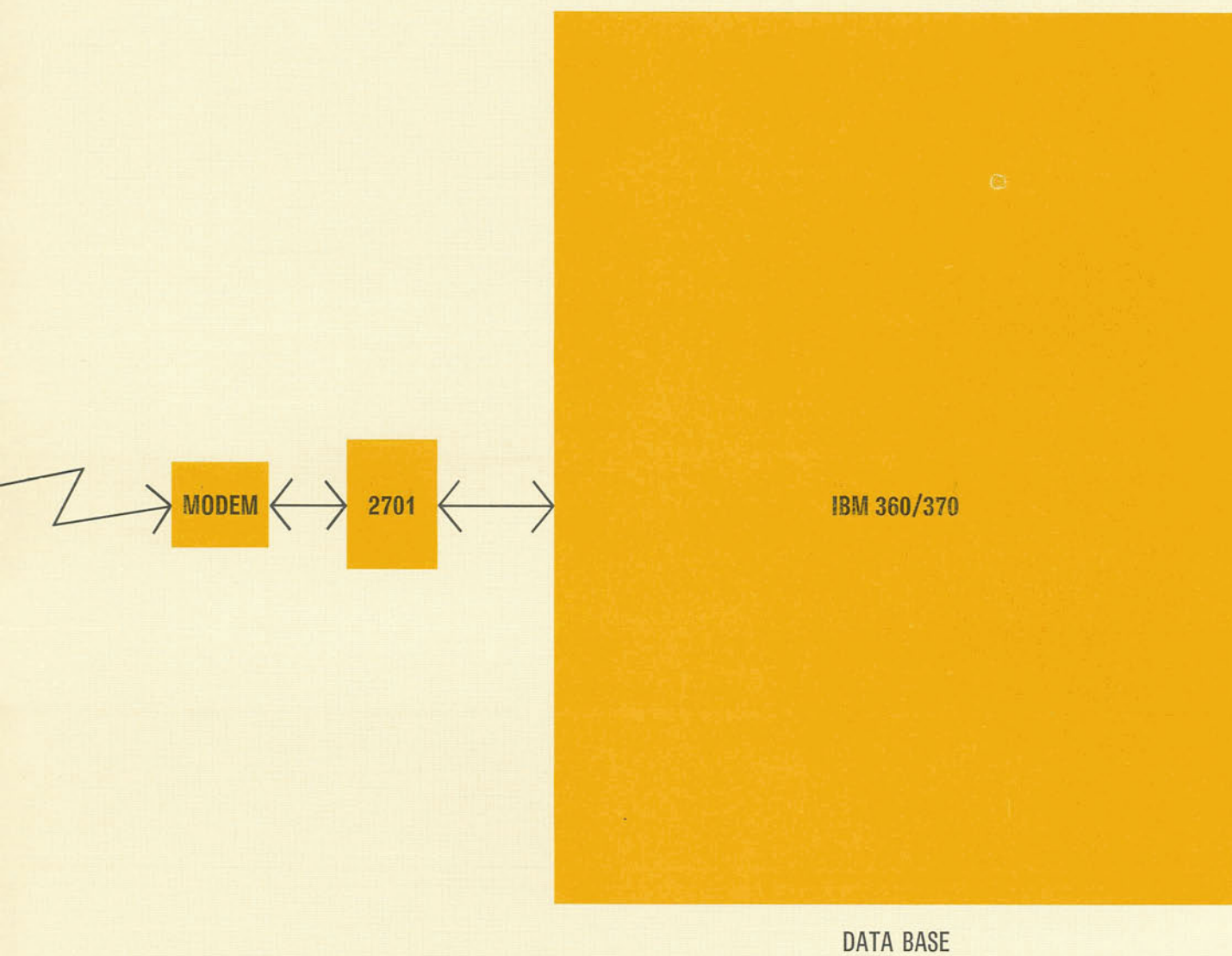
System IV/70



The Sy



ystem.



A display processing system that combines a medium scale business-oriented computer with up to 32 interactive CRT terminals

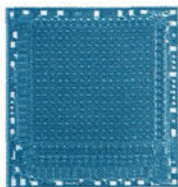
Applying the most sophisticated MOS/LSI technology, Four-Phase Systems has created the industry's first semiconductor mainframe memory **and** the first LSI CPU. They are produced at our own semiconductor and systems manufacturing facility where all critical steps are under Four-Phase control. Because of these innovations, System IV/70 realizes production economies which are reflected in prices substantially below those of competitive equipment of lesser capability.



System IV/70's 12-chip CPU is equivalent in computing power to a System/360, Model 30. It contains over 75,000 transistors.

System IV/70's 24K-byte memory is composed of 1024-bit LSI chips. It contains over 1,500,000 transistors.

A data display system with a mind of its own



System IV/70 is a multi-terminal display-processing system that provides on-line access to IBM 360/370 and other computer-based file-management systems. Employing

the most advanced large scale integrated circuits in production today, System IV/70 makes real-time data entry and retrieval economically feasible for a broad spectrum of applications in finance, insurance, credit management, and business.

A new concept in systems architecture

In System IV/70 the memory and control requirements of up to 32 keyboard/display terminals are combined with the mainframe memory and logic of the IV/70 Central Processing Unit. As a result, data is displayed directly from refresh areas of System IV/70's parallel-accessed LSI memory, eliminating the cost of separate buffer memories in every terminal. Using this technique, exceptionally high video throughput results, enabling new information to be displayed at a rate of 395,000 characters per second.

System IV/70's CRT terminals may be located up to 1000 feet from the IV/70 Central Processing Unit which controls all communication between terminal operators and the central data base located either on-site or many miles away. Significantly more powerful than a conventional display controller, System IV/70's CPU possesses the computing power of an IBM System/360, Model 30 and is complemented by a wide selection of optional data-communications and peripheral equipment.

Flexible long-life design

Because all edit and control functions are software managed, System IV/70 easily adapts to present and future operating requirements. For example, the system may be used initially as a plug-compatible replacement for the IBM 2260/2848 Display System. As demands increase, applications software may be added to perform local pre-processing and reduce communications costs. Finally, the system may serve as a stand-alone display-oriented computer, programmed to handle a dedicated application.

IBM compatible 2260/2848 replacement

When operated with the IV/70 2260 Simulator program which is supplied, System IV/70 duplicates the operation of an IBM 2260/2848 Display System and can be brought on-line immediately with IBM 360 and 370 computers for operation with standard 2260 application programs. *No modification of IBM software is required.* In addition to providing complete hardware and software compatibility at a lower cost than the 2260/2848, System IV/70 offers superior editing capability, more flexible screen formatting, greater character legibility, and reduced requirements for operating power and space. The system may be expanded at any time to more fully employ the power of the IV/70 Central Processing Unit.

On-line display preprocessing system

With the addition of background applications programs, System IV/70 can communicate more efficiently with the central computer and can increase the productivity of data-entry and file-search personnel. Because display and communications functions require only 10 to 20 percent of the Central Processing Unit's time, 80 to 90 percent is available for background data validation, error checking, and data pre-processing before transmission to the central computer. In addition, System IV/70 can reduce central-computer interrupts and improve terminal response time by performing many of the functions of a communications processor such as code translation, message reformatting, and bulk data buffering.

System IV/70 substantially reduces communications costs in data-entry applications where operators type information in multiple fixed formats. With the touch of a key, hundreds of formats may be called from local disc storage and displayed in milliseconds, freeing communications circuits for transmission of variable data. Similarly, words, lines, or complete blocks of text may be displayed instantly by the transmission of control characters only, multiplying the efficiency of cued source-data-entry and conversational search operations where detailed operator instructions are displayed in an interactive process.



Stand-alone display processing system

Other preprocessing functions can include checking numeric and alphabetic fields for extraneous characters, testing financial data against upper and lower limits to prevent gross error, and performing zero-balance calculations on account data. The Central Processing Unit may also be used to compute percentages, moving averages and variances as data is entered, or to cipher and decipher information for secure transmission. Data may be optionally entered off-line during the day for later transmission when lower evening rates apply, and a fall-back mode may be programmed to allow continued data entry during communications interruptions or central computer down time.

In stand-alone configurations, the full power of the Central Processing Unit may be employed to support a dedicated assignment. In such applications, System IV/70's integrated architecture offers improvements in performance and reductions in cost over systems not optimized for video support. IV/70 Displays, for example, by changing full screens of information in less than three milliseconds, offer unusual opportunities for high speed interchange and response-time measurement. The system's simple programming and complete documentation insure rapid system development and easy maintenance.

System IV/70 combines the power, versatility, and economy required by organizations who need real-time information management *now*.

The Central Processing Unit

This is the System IV/70 Central Processing Unit, Model 7001. More than a video controller, it is a full-scale digital computer.

It represents a new generation of electronic systems, because it is designed wholly with Large Scale Integrated (LSI) circuits. LSI devices perform the same functions as conventional semiconductor devices, but at less cost, with greater reliability and in a fraction of the space.

The Model 7001 CPU is designed exclusively with Four-Phase-developed micro-miniature circuitry. The result is a video-oriented digital computer with sufficient power to perform the most demanding terminal tasks.

Memory

- ☐ 1.9 microsecond Random Access Memory (RAM)
The industry's first *all*-semiconductor memory replaces conventional core storage in System IV/70.
- ☐ Multi-use Design
The new memory serves double duty. It is used for both processor storage and display refresh simultaneously. The refresh buffers are actually dedicated memory locations. A new picture is displayed automatically whenever these locations are changed.

- ☐ Expandability
Starting from a basic 12,288 bytes, memory can be expanded to 24,576 bytes of on-line storage.
- ☐ Multiple Information Formats
A basic 24-bit word is used to represent these varied information formats:
 - a variable-length string of 8-bit bytes
 - a signed 24-bit integer
 - an unsigned 24-bit logical value
 - a fixed-length string of 8-bit bytes, 3 bytes per word
 - a single or double-precision floating-point number
 - a string of unpacked decimal digits, one per byte

Addressing

- ☐ Direct Addressing
The total memory is directly addressable on a word basis without the need for extension registers, base registers, or indirect addressing.
- ☐ Indirect Addressing
Indirect addressing to a single level with or without pre-indexing may be used.
- ☐ Multiple Index Registers
Three 24-bit hardware index registers are available for address modification.



Speed

Typical Instruction Times (μsec):

N=No. of bytes, W=No. of words

Character move	$38+2.5N$
Character Compare	$38+3.8N$
Decimal Add/Subtract	$38+5.1N$
Multiple Word Move	$12+8W$
Binary Add/Subtract (24 bits)	15.2

Registers

☐ Condition Codes

A 4-bit condition code allows quick determination of Overflow, Zero, Minus, and Carry status at the completion of instruction execution.

OZMC

☐ General Registers

The 7001 processor has eight multi-function registers for control, temporary, and arithmetic use. Each register is 24 bits in length.

RO	Zero Register
R1	One's Register
RP	Program Counter
RA	Accumulator
RB	Extended Accumulator
X1	Accumulator and Index Register
X2	Accumulator and Index Register
X3	Accumulator and Index Register

Instruction Formats

Because there are only two basic instruction formats, the CPU is particularly easy to use. Each of these formats occupies only a single word of memory.

☐ Memory Reference

OP	S	D	B	C
-----------	----------	----------	----------	----------

- OP Operation Code (6 bits)
- X Index Register Selection (2 bits)
- I Indirect Address (1 bit)
- M Memory Address (15 bits)

☐ Non-Memory Reference

OP	X	I	M
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- OP Operation Code (6 bits)
- S Source Register (3 bits)
- D Destination Register (3 bits)
- B Byte Control (3 bits)
- C Count (6 bits)

Instruction Repertoire

A powerful group of 116 major instructions allows System IV/70 to accomplish large processing tasks. The instruction set, which is listed on page 13, includes all the tools medium-to-large computer users have come to expect.

Priority Interrupt System

The nested priority interrupt system of System IV/70 enables it to satisfy the critical real-time demands of a multi-user environment.

Eight distinct levels of priority interrupt are provided with unique memory locations. Hardware provides automatic recognition of the highest priority level, eliminating complicated and time-consuming software processing. Each level may be controlled by the program to discontinue or defer response.

An Indirect Interrupt (I/OID) instruction, when used in an interrupt location, allows a single interrupt level to be automatically demultiplexed into 64 sublevels. The Increment Memory (INR) instruction can be used in an interrupt location to effect a clock counter.

Input/Output Facilities

The CPU has eight I/O channels, each of which can accommodate 64 separate devices. Each device controller includes data buffering for one or three bytes to reduce the number of accesses required. All data transfers proceed without disturbing any registers.

☐ Multiplexed Program Data Transfer

In this mode, any number of I/O operations may proceed concurrently, with each channel being driven by the interrupt system. Aggregate rates up to 49,000 bytes per second can be accommodated.

☐ Lock-Up Data Transfer

In this mode, the CPU devotes its full attention to the I/O activity for the duration of the transfer. The data rate may be as fast as 395,000 bytes per second.

Console

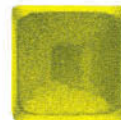
The operator's control console consists of a back-lighted panel with 24 data-entry/sense switches, 10 control switches including a console interrupt, and a console key lock.

Physical Specifications

Cabinet Dimensions 10½" H x 17" W x 21" D
Weight 75 pounds
Power 500 watts max.

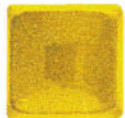
The Keyboard

Keyboards are used by people. The design of the Model 7200 alphanumeric keyboard is the result of a careful study of user needs and human factors. The 85-key typewriter style keyboard offers Upper Case, Lower Case, and Control Shift for generating all ASCII codes. As a standard feature, eleven assignable function keys, seven cursor control and edit keys, and a 14-key "data island" entry cluster are included. The unit possesses a key touch which allows high speed typing. The keyboard is attached to the display by a flexible cable so that its placement can be adjusted for individual preference. All control and cursor keys are shaded for ease of identification. The placement of the keys on the keyboard is consistent with the type and frequency of usage. Due to the unique scanning method employed in the keyboard interface, individual letters are not constrained to particular keys. This freedom allows the keys to be located for convenient operation. For example, arithmetic keys can be struck without the necessity of shifting. The entire unit is mounted in a stepped orientation to minimize operator fatigue.



Eleven function keys are provided for convenient transaction-code input. They can be assigned specific application-dependent functions under program control. The Control key operates as another shift mode, allowing generation of 53 additional function codes to extend the range of system usefulness. The Attention key is isolated from the main keyboard group so it can be quickly located when a new mode, escape, or help function is desired.





The blocked numeric keyboard island is ideal for high-speed, heavy-volume data-entry tasks.

It can be used in both lower-case and upper-case shift mode. The island may also be used for conventional adding-machine operations. Special double-sized + and - keys make the block familiar and easy to use.



A complete cursor-control and edit section is provided for various display functions. These standard assignments can be

changed under program control to provide virtually any display operation. Tab generates three different codes (shifted, unshifted, control shift) for Vertical, Horizontal, and variable tabulation use.

Display key functions include:

- Cursor Right, Cursor Down, Cursor Left, Cursor Up
- Move cursor to home
- Cursor Return to next line
- Roll Up, Roll Down a line
- Insert a character in a line
- Delete a character in a line
- Erase the screen
- Erase a line
- Insert line
- Delete line

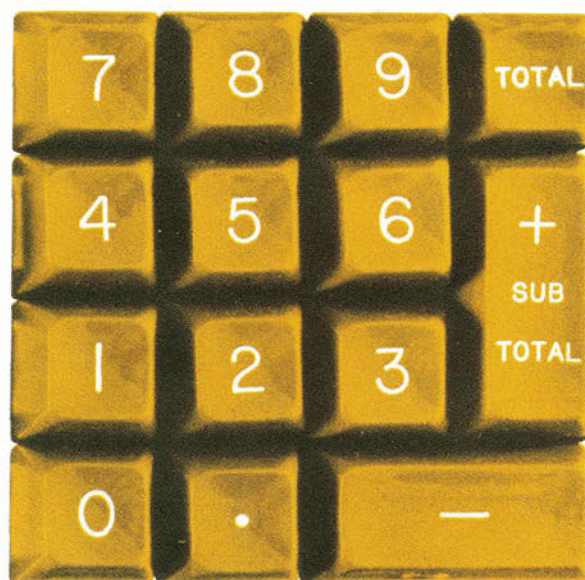
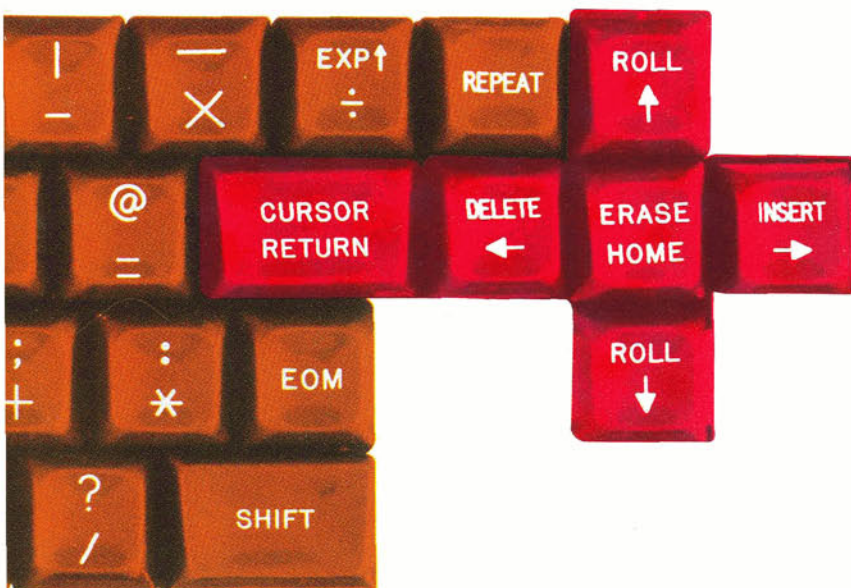


In addition to all normal typewriter-key functions, the keyboard also includes:

A Repeat Key, which, when depressed in conjunction with any other key, allows automatic repetitive data entry at a ten character-per-second rate.

A unique MOS/LSI coding scheme which generates a total of 173 unique codes and insures reliable operation.

A two-key roll-over feature which eliminates data loss during high speed input.



Physical Dimensions

Front Height:	2"
Rear Height:	3 1/2"
Width:	18 3/8"
Depth:	7 5/8"

The Display

Highest visual quality and unmatched speed are combined in System IV/70 Video Terminals which display up to 1152 clear, bright, flicker-free characters. Because the displays refresh directly from the Central Processing Unit's MOS/LSI mainframe memory, new information may be transferred to a display area at a rate of 395,000 characters per second, allowing complete screens to be updated in less than three milliseconds. In disc-oriented systems, full-screen formats and other data may be called instantly from local storage, avoiding the transmission delays, communications costs, and main computer overhead associated with conventional display controllers.

Optimal Legibility

The character set includes 120 upper case, lower case, and special characters, and can display all ASCII, EBCDIC, Teletype, and IBM 2260 and 2265 symbols. The 8x10 dot-matrix font is the result of an extensive human-factors analysis and is optimized to minimize error rate and reaction time while adhering to traditional shapes to preserve aesthetic appeal. In independently conducted tests, the font was consistently found to be superior to both stroke and 5x7 dot-matrix representations in terms of legibility, identification time, and character aesthetics. For maximum eye comfort, characters appear in green against a dark charcoal background on a 12-inch CRT protected by a bonded UL-approved 1/4 inch etched gradient-density face plate.

Multiple Cursors

Six popular cursor symbols are available, any of which may be blinking or steady, nondestructive or destructive. For applications such as text editing and computer-aided instruction, multiple cursors may be programmed on the same display for more powerful control capability.

Flexible Formatting

Because all video displays are under control of the Central Processing Unit, unlimited flexibility exists to accommodate specific requirements. Standard features include fixed and variable field capability for split or segmented screens and "fill in the blanks" data entry. Operators can visually verify and edit all data before transmission, and protected data is automatically deleted to reduce communication overhead. Selective blink capability is also available for characters, words, lines, blocks, and screens, and any number of characters may be suppressed for entry of confidential information or restricted access. Expanded capabilities such as forward and reverse scrolling for rapid browsing through multipage files or one-key entry of commonly used words or blocks for faster form filling may also be added at any time.

Custom Configuration

Two display models allow System IV/70 to be configured for either 48 or 81-character lines as shown below. (40- or 80-character lines are obtained by blanking.) Screens may be segmented to accommodate up to thirty-two 288-character terminals as illustrated. Displays can be located up to 1000 feet from the Central Processing Unit, and hard copy may optionally be obtained from a selection of printers located either at the Central Processing Unit or at the terminals. Configurations involving terminals with multiple screens, duplicate screens, or integrated screens are also possible.

DISPLAY CONFIGURATIONS

DISPLAY MODEL	CHARACTERS PER LINE	Screen Size	Lines per Display	Characters per display	Maximum Displays per System
7100	48	Full	24	1152	8
		Half	12	576	16
		Quarter	6	288	32
7101	81	Full	12	972	8
		Half	6	486	16
		Third	4	324	24

Physical Specifications

Cabinet Dimensions
Weight
Power
Operator Controls

12" x 12" x 13"
20 pounds
115 vac, 60 Hz, 60 watts
On/Off, Brightness

- CALL FORMATS FROM LOCAL STORAGE

Name: Address:
City: State:

- USE 120 DIFFERENT CHARACTERS

A quick brown fox jumps over the lazy dog.
A QUICK BROWN FOX JUMPS OVER THE LAZY DOG.
\$2.98 45¢ £12-4-3 50% 72°F 3/4 #1743
 $9 \{ [(8+7) \div (5 \times 3)] - 1 \} = 45$
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- CONSTRUCT BLOCK DIAGRAMS AND CHARTS



Software



Comprehensive software supplied with System IV/70 allows immediate operation as an IBM-equivalent 2260/2848 Display System and speeds development of powerful application programs.

2260 Simulator

The 2260 Simulator provides a complete simulation of an IBM 2260/2848 Display System. It enables System IV/70 to be operated upon delivery with IBM 360/370 computers supporting standard 2260 application programs. The 2260 Simulator provides for all valid 2848 commands and supports 40- or 80-character/line System IV/70 video terminals. It is completely "interrupt driven" and allows easy insertion of pre- or postprocessing background programs. An extended mode supports the additional capabilities of System IV/70 video terminals. The 2260 Simulator operates with unmodified IBM software and requires *no* changes in the Device Dependent Module. Provisions for hard-copy output are included.

Video Display Library

The Video Display Library is designed to give a programmer a package which can be assembled easily for specific display tasks. Customer's video systems become operational quickly because most commonly used functions are already implemented. The library includes such routines as keyboard-input processing, cursor control and edit, and other basic building blocks.

Disc Operating System (DOS)

DOS operates with peripheral disc-storage units to extend System IV/70's usefulness. It provides for simple batch operation in program assembly and loading. Source files may be kept on disc, edited, and used as input to CODE, the assembler. A disc checkpoint feature speeds debugging time.

Sort/Merge

The Sort/Merge package permits users to obtain maximum benefit from the processing time available in System IV/70. For flexibility, all sorting procedures operate on variable-length records. An optional "user own" routine performs actual comparisons between keys and offers the flexibility of sorting to any desired criteria. For additional compatibility, all sort routines contain the provision for COBOL input/output procedures.

Code

CODE is a two-pass symbolic assembler offering the user many coding aids. Forward references, storage allocation, and constant defining capability are provided along with conditional assembly features. Relocatable code is generated.

Check

CHECK is a complete collection of hardware-diagnostic programs which minimize down-time. Memory (M/CHECK), Processor (P/CHECK), and Input/Output (I/O CHECK) diagnostics verify system operational integrity by selectivity testing individual circuits in a progressive logic manner. Malfunctions are quickly isolated and reported by detailed error messages on the display to eliminate operator guess work.

Utility Packages

These packages are designed for maximum system utilization. The Symbolic Editor allows insertion, deletion, replacement, and inter-record corrections of symbolic text. Media conversion from one peripheral to another includes as a subset, card-to-tape, tape-to-printer, paper-tape copying, and so on. Memory save-restore with disc, paper tape, or magnetic tape speeds program checkout. The Relocatable Loader loads object modules produced by the CODE assembler and satisfies external references.

Math

Math is a complete library of mathematical functions. Written in CODE assembly language, the library includes both standard and extended precision functions.

Data Communications



System IV/70 communicates with IBM 360's and 370's and with other remote computers and terminals synchronously or asynchronously at varying speeds over private or dial networks.

Asynchronous Data Set Controller, Model 8411

The asynchronous data set controller operates with Bell type 103A, 113, 202C/D, 201B/D, and equivalent data sets and acoustic couplers at speeds of 110, 134.49, 150, 300, 600, 1200, 1800, or 2400 baud. Automatic answer provisions allow System IV/70 to be called by an outside source for unattended data transfer.

Internal 103A Type Data Set (300 Baud), Model 8421

Internal 202C Type Data Set (1200 Baud), Model 8425

These internally mounted data sets are designed for use with the Bell Data Access Arrangement and include automatic dialing provisions to allow System IV/70 to call an outside source.

Synchronous Data Set Controller, Model 8435

The Synchronous Data Set Controller operates with Bell type 201A, 201B, and other synchronous data sets at speeds up to 9600 baud.

Local System/360 Attachment

The Model 7071 System/360 Channel Adapter provides a direct interface between System IV/70 and an IBM System/360 selector or multiplexer channel for local multi-terminal applications.

Peripherals



System IV/70 is complemented by a complete line of field-proven peripheral equipment which extends the system's productivity and usefulness. The Model 8143 Line Printer, for example, can

print the contents of a full-screen display on six-part paper in two seconds. The Model 8215 Disc Storage Unit can store 700 screen formats for quick local access.

Keyboard Printers

- 8100 Teletype Controller
- 8113 Teletype Model 35ASR
10 cps heavy duty keyboard/printer with 10 cps paper tape reader/punch
- 8121 IBM Selectric Output Writer
15.5 cps output with 88 printable characters (upper and lower case)

Line Printers

- 8143 Line Printer
80 columns, 356 LPM, 96-character font impact printer
- 8145 Line Printer
132 columns, 200 LPM, 96-character font impact printer

Disc Memory

- 8211 Disc Memory and Controller—Fixed Head
365K byte capacity, 180K byte/sec transfer rate, 17 msec average access time
- 8215 Disc Memory and Controller—Fixed Head
737K byte capacity, 180K byte/sec transfer rate, 17 msec average access time
- 8230 Disc Controller—Moving Head
60 msec average head-positioning time, 92K byte/sec average transfer rate. (Controls up to four 8231 units)
- 8231 Disc Drive—Moving Head
Removable IBM type 2315 cartridge with 2.5 megabyte capacity

Paper Tape

- 8301 Paper-Tape Reader and Controller 400 cps
- 8311 Paper-Tape Punch and Controller 120 cps

Magnetic Tape

- 8501 Magnetic Tape Controller
- 8511 Magnetic Tape Drive
Industry-compatible 9-track, 800 BPI, 20K byte/sec transfer rate

The Technology

System IV/70 represents a new generation of electronic systems which utilize Large Scale Integrated (LSI) circuit arrays. LSI devices are the result of a revolution in semiconductor manufacturing processes. They perform the same function as conventional semiconductor devices, but they do it with greater economy, more reliably, and in a fraction of the space.

A unique design staff permits FOUR-PHASE SYSTEMS to fully exploit this technology. Inside the plant, traditional divisions of computer and component design have been dissolved. There is only one task: design of the total system. By promoting the free exchange of ideas between computer and component disciplines, new advances in efficient system design were derived. In the process, milestones in technology were achieved making the result real.

Using advanced metal-oxide-silicon (MOS) technology, FOUR-PHASE SYSTEMS has succeeded in packing up to 10,000 electronic component functions on a single chip of silicon of microscopic proportions. In the System IV/70 computer, for example, the entire central processing unit—the equivalent of 75,000 components—resides on 12 LSI chips which are mounted on one plug-in circuit board.

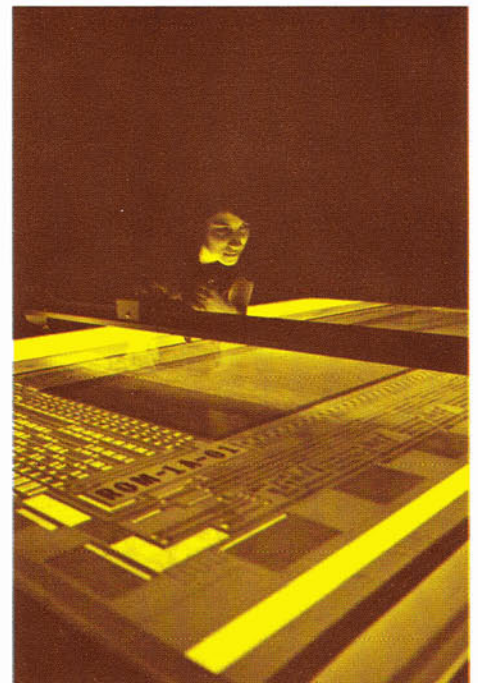
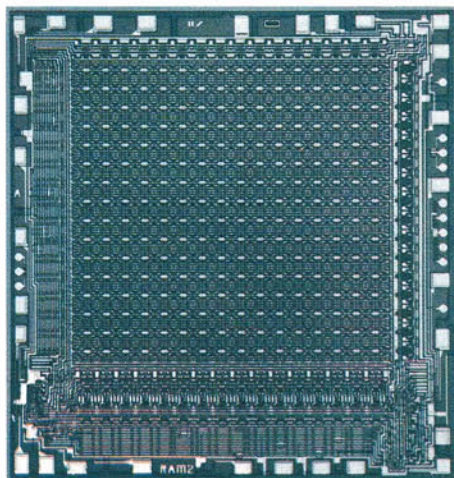
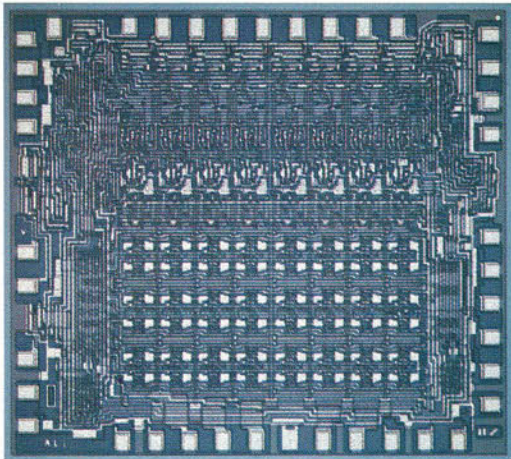
The economic advantages are obvious. Since the components are "assembled" in the diffusion process, assembly-line labor costs are virtually eliminated. With the possibility of human error thus reduced, product yield is proportionately increased.

Improvements in reliability are equally impressive. The bulk of the interconnections are etched into the silicon chips in manufacturing—reducing the number of movable mechanical interconnections (where most failures occur) by a ratio of 30:1 compared with systems using conventional integrated circuits. Reliability is improved by the same factor. The use of LSI also reduces the number of circuit boards required and reduces heat generation, resulting in a lower component failure rate.

In System IV/70, the same MOS/LSI techniques used to reduce the CPU to 12 components are also applied to the *core equivalent* memory, so that 24,576 bits of random-access memory are contained in 24 components on a single 8" x 10" card.

For the user, another major improvement in LSI-based systems is the vast reduction in maintenance requirements. With each major block of the system mounted on its own individual low-priced card, failures can be quickly isolated. The entire card can then be replaced so that the system continues to function while the defective components are being isolated and replaced. The cost of keeping duplicate boards on hand is minimal compared with losses due to down time with conventional systems.

FOUR-PHASE SYSTEMS was formed to apply the advantages of MOS/LSI technology to computer equipment. System IV/70 is only the beginning.



Customer Support Service

The Four-Phase Approach . . .

Four-Phase Systems is dedicated to helping our customers bring man/machine interactions to their fullest potential. We believe the most effective way of accomplishing this is by providing complete service through *all four phases* of systems education, engineering, test, and on-site support.

Systems Education Support

Courses in programming and instruction in operating are offered at Four-Phase Branch Offices and customer locations. Ample time is provided for hands-on experience, and complete documentation is furnished to maximize system utilization. Support literature includes programmers reference manuals, operating procedures, and detailed technical descriptions.

Systems Engineering Support

Experienced Systems Engineers at Four-Phase Branch Offices are available to assist your data-processing personnel in application definition and systems design. They will help with installation planning, advise on programming techniques, and assist with program testing and checkout.

Systems Test Support

To insure reliable performance and serviceability at your facility, every system is fully assembled at the factory before shipment, configured with operating software, and thoroughly tested using comprehensive diagnostics. Before installation, user programs may be checked out on System IV/70 at Customer Support Centers in Four-Phase Branch Office locations.

Installation and Maintenance Support

Four-Phase Customer Engineers provide overall technical coordination during system installation and checkout at your facility. Purchased systems are backed by a 90-day warranty, and on-site maintenance beyond this period is provided by an optional contract. Lease contracts include maintenance service.

